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EDUCATION

Ph.D. (Environmental Engineering) and M.A. (Statistics) University of California, Berkeley, CA, 2001

> Thesis: *Bayesian Approach for Subsurface Characterization Using Hydrogeological and Geophysical Data*

M.S. (Environmental Fluid Mechanics) Georgia Institute of Technology, Atlanta, GA, 1997

M.Eng. (Hydrology and Water Resources) Tsinghua University, Beijing, China, 1990

B.Eng. (Water Resources Engineering) and B.S. (Applied Mathematics) Tsinghua University, Beijing, China, 1988

RESEARCH INTERESTS

My research interests are interdisciplinary and across surface and groundwater hydrology, geophysics, and statistics. My primary research focus is on the development and application of statistical and mathematical models for solving complex problems in earth and environment sciences. My current research areas include

Hydrogeophysics

Hydrogeophysics is the use of geophysical methods for imaging subsurface properties and for monitoring important processes related to hydrogeological studies. One main challenge in hydrogeophysics is the lack of effective methods for integrating multi-scale and multi-source information, such as geological, hydrogeological, geophysical, geochemical, and biological data. The goal of my research is to develop statistical models for combining such diverse datasets. Examples of my research in this area are:

- Developed a Bayesian method based on a normal linear regression model to combine crosswell seismic and ground-penetrating radar (GPR) tomographic data with borehole flowmeter test measurements to estimate hydraulic conductivity (*Chen et al., 2001, WRR*)

- Developed a statistical model based on data collected from the DOE South Oyster Site to estimate the spatial distribution of field-scale extractable Fe(II) and Fe(III) using GPR tomographic attenuation data and various borehole logs (*Chen et al., 2004, WRR*).

- Developed a joint inversion approach to estimate fracture zonation along several cross sections at the DOE NABIR Field Research Center in Tennessee using seismic traveltimes, flowmeter test data, and Markov chain Monte Carlo methods (*Chen et al., 2006, WRR*).

- Developed a state-space stochastic approach (extended Kalman filter) to combine time-lapse seismic attenuation and complex resistivity data for monitoring the evolution of microbially mediated precipitation during bioremediation processes (*Chen et al., 2006*, *Eos Trans. AGU*).

Geophysical Inverse Problem

I formulate the geophysical inverse problem within the Bayesian framework and use Markov chain Monte Carlo (MCMC) sampling methods to explore the joint posterior probability distribution. The main task of my research in this area is to develop efficient (typically problem-specific) MCMC sampling strategies and fast numerical algorithms for the problem under study. Examples of my research are:

- Developed a stochastic model to estimate reservoir porosity and water saturation using borehole porosity and water saturation measurements, crosswell seismic P- and S-wave traveltimes, and the inverted 2D electrical conductivity data (*Chen and Hoversten, 2003, SEG Expanded Abstract*).

- Developed a Bayesian model to estimate reservoir gas saturation using 1D marine seismic amplitude versus angle (AVA) and controlled source electromagnetic (CSEM) data, and utilize MCMC sampling methods to explore the joint posterior probability distribution (*Chen et al. 2007, Geophysics; Chen et al., 2004, SEG Expanded Abstract*).

- Developed a Bayesian model to estimate reservoir parameters using seismic and electromagnetic data and stochastic rock physics models (*Chen and Hoversten, 2005, SEG Expanded Abstract; Chen and Dickens, 2007, SEG Expanded Abstracts*).

Environmental Applied Statistics

I am interested in applying a variety of statistics methods to solve other problems in earth and environment sciences, especially those problems in surface and groundwater hydrology. The goal of my research is to solve problems using integrated, effective, and conceptually consistent approaches. The statistics methods used include spatial statistics (geostatistics), time series analysis, Bayesian statistics with MCMC sampling methods, multivariate data analysis, linear and nonlinear regression, and multiple testing techniques.

PROFESSIONAL MEMBERSHIPS

- American Geophysical Union (AGU)

- Society of Exploration Geophysicists (SEG)

- American Statistical Association (ASA)

PROFESSIONAL EXPERIENCE

Geological Scientist, Lawrence Berkeley National Laboratory, Berkeley, CA, 4/2004—Present

Research Statistician, University of California, Berkeley, CA, 10/2005—8/2006

Research Engineer, University of California, Berkeley, CA, 2003—2005

Postdoctoral Fellow, Lawrence Berkeley National Laboratory, Berkeley, CA, 2003

Postdoctoral Fellow, University of California, Berkeley, CA, 2002

Research Scientist and Lecturer, Tsinghua University, Beijing, China, 1990-1995

PUBLICATIONS

Papers in Refereed Journals

Chen, J., and S. Hubbard (in revision), Inversion of induced polarization data for Cole-Cole model parameters using Markov chain Monte Carlo methods, *Geophysical Research Letters*.

Chen, J., M. van der Laan, M. Smith, and A. Hubbard (in revision), What multiple testing procedure to use? Comparing methods to control Type-I errors in microarray studies, *Bioinformatics*.

Hou, Z., Y. Rubin, and **J. Chen** (in revision), On application of ray-tracing methods when using tomographic GPR in vadose zone hydrology, *Water Resources Research*.

Chen, J., M. Hoversten, D. Vasco, Y. Rubin, and Z. Hou (2007), A Bayesian model for gas saturation estimation using marine seismic AVA and CSEM data, *Geophysics,* Vol. 72, No. 2, P. WA85-WA95

Hou, Z., Y. Rubin, M. Hoversten, D. Vasco, and **J. Chen** (2006), Reservoir parameter identification using minimum relative entropy based Bayesian inversion of seismic AVA and marine CSEM data, *Geophysics*, Vol. 71, No. 6, P.O77-O88.

Chen, J., S. Hubbard, J. Peterson, K. Williams, M. Fienen, P. Jardine, and D. Watson (2006), Development of a joint hydrogeophysical inversion approach and application to a contaminated fractured aquifer, *Water Resources Research*, 42(6).

Rubin, Y., M. Hoversten, Z. Hou, and **J. Chen** (2006), Risk reduction in gas reservoir exploration using joint seismic-EM inversion, *Gas TIPS*.

Kowalsky, M., **J. Chen**, and S. Hubbard (2006), Joint inversion of geophysical and hydrological data for improved subsurface characterization, *The leading Edge,* 25, 730.

Hoversten, M., F. Cassassuce, E. Gasperikova, G. Newman, **J. Chen**, Y. Rubin, Z. Hou, and D. Vasco (2006), Direct reservoir parameter estimation using joint inversion of marine seismic AVA and CSEM data, *Geophysics*, 71, C1.

Scheibe, T. D., Y. Fang, C. J. Murray, E. E. Roden, **J. Chen**, Y.-J. Chien, S. C. Brooks, and S. S. Hubbard (2006), Transport and biogeochemical reaction of metals in a physically and chemically heterogeneous aquifer, *Geosphere*, 2(4).

Chen, J., S. Hubbard, Y. Rubin, C. Murray, E. Roden, and E. Majer (2004), Geochemical characterization using geophysical data and Markov chain Monte Carlo methods: a case study at the South Oyster Bacterial Transport Site in Virginia, *Water Resources Research,* 40(12).

Chen, J., and Y. Rubin (2003), An effective Bayesian model for lithofacies estimation using geophysical data, *Water Resources Research,* 39(5).

Chen, J., S. Hubbard, and Y. Rubin (2001), Estimating the hydraulic conductivity at the South Oyster Site from geophysical tomographic data using Bayesian techniques based on the normal linear regression model, *Water Resources Research*, 37(6).

Hubbard, S., **J. Chen**, J. Peterson, E. Majer, K. Williams, D. Swift, B. Mailloux, and Y. Rubin (2001), Hydrogeological characterization of the South Oyster Bacterial Transport Site using geophysical data, *Water Resources Research*, 37(10).

DeFlaun, M., ..., **J. Chen**, and Others (2001), Breakthroughs in bacterial transport, *EOS Transactions*, Article, 82(38).

Ezzedine, S., Y. Rubin, and **J. Chen** (1999), Bayesian method for hydrogeological site characterization using borehole and geophysical survey data: theory and application to the Lawrence Livermore National Laboratory Superfund Site, *Water Resources Research*, 35(9).

Chen, J., and X. Lin (1994), Self-optimization of water resources systems simulation, *Journal of Tsinghua University (Science & Technology)*, 34(2).

Chen, J., and X. Lin (1993), Self-optimization problems in large-scale water resources systems, *Hydro-energy Technique and Economy*, 49(2).

Papers in Conference Proceedings and Books

Chen, J., and T. Dickens (submitted), Effects of uncertainty in rock-physics models on reservoir parameter estimation using marine seismic AVA and CSEM data, *SEG Expanding Abstracts* .

Linde, N**., J. Chen**, M. Kowalsky, and S. Hubbard (2006), Hydrogeophysical parameter estimation approaches for field scale characterization, In *Applied Hydrogeophysics*, edited by H. Vereecken et al., Chapter 2, 9-44, Springer.

Chen, J., and M. Hoversten (2005), Estimating reservoir parameters from seismic and electromagnetic data using stochastic rock physics models and Markov chain Monte Carlo methods, *SEG Expanded Abstracts,* 24, 1437.

Hoversten, M., **J. Chen**, E. Gasperikova, and G. Newman (2005), Integration of marine CSEM and seismic AVA data for reservoir parameter estimation, *SEG Expanding Abstracts,* 24, 579.

Hou, Z., Y. Rubin, M. Hoversten, **J. Chen**, and D. Vasco (2005), MRE-based Bayesian inversion of seismic and EM data for identification of reservoir parameters, *SEG Expanded Abstracts,* 24, 635.

Chen, J., M. Hoversten, D. Vasco, Y. Rubin, and Z. Hou (2004), Joint stochastic inversion of seismic AVO and EM data for gas saturation estimation using a sampling-based stochastic model, *SEG Expanded Abstracts,* 23, 236.

Chen, J., S. Hubbard, and J. Peterson (2004), A comparison between hydrogeological characterization approaches applied to granular porous and fractured media, *The Proceedings of International Symposium on the Dynamics of Fluids in Fractured Rock*, Berkeley, California, February 10-12.

Chen, J., and M. Hoversten (2003), Joint stochastic inversion of geophysical data for reservoir parameter estimation, *SEG Expanded Abstracts,* 22, 726.

Chen, J., and Y. Rubin (2002), Characterizing lithofacies from borehole and crosswell geophysical data using Bayesian methods coupled with fuzzy neural networks, *The Proceedings of International Groundwater Symposium,* Berkeley, California, March 25-28.

Chen, J., and X. Lin (1992), Sensitivity analysis of weight vectors in multiple criteria decisions, 7th *SESC (System Engineering Society of China) Annual Conference Papers*.

Chen, J., and X. Lin (1990), Multi-objective decision theories and methods in large-scale hydraulic engineering, *Collection of System Engineering Papers on Hydraulic Engineering*.

Selected Abstracts

Englert, A, S. Hubbard, K. Williams, **J. Chen**, J. Peterson, A. Kemna, F. Spane, D. Newcomer, and P. Long (2007), Hydrogeophysical field characterization at the DOE Old Rifle Site, CO, *Eos Trans. AGU*., 88(23), Jt. Assem. Suppl., Abstract H31F-05.

Faybishenko, B., P. Long, T. Hazen, S. Hubbard, K. Williams, J. Peterson, **J. Chen**, E. Volkova, D. Newcomer, C. Resch, K. Cantrell, M. Conrad, E. Brodie, D. Joyner, S. Borglin, R. Chakraborty (2007), A conceptual model of coupled biogeochemical and hydrogeological processes affected by Cr(VI) bioremediation in groundwater at Hanford 100H Site, *Eos Trans. AGU*., 88(23), Jt. Assem. Suppl., Abstract H32B-03.

Chen, J., S. Hubbard, M. Hoversten, and A. Hubbard (accepted), A Bayesian model for inversion of geophysical seismic and electromagnetic data, *2007 Joint Statistical Meetings*, Salt Lake City, Utah, July 26-August 2, 2007.

Chen, J., S. Hubbard, K. Williams, A. Kemna, L. Slater, and S. Pride (2006), A stochastic framework for geochemical parameter estimation using geophysical methods: development and application, *Eos Trans. AGU*., 87(52), Fall Meet. Suppl., Abstract H44B-04.

Hubbard, S., K. Williams, T. Scheibe, J. Peterson, **J. Chen**, S. Mukhopadhyay, E. Sonnenthal, and C. Steefel (2006), Improved understanding of natural system processes through coupling of geophysical characterization and numerical modeling approaches, *Eos Trans. AGU*, 87(52), Fall Meet. Suppl., Abstract H41G-01.

Mok, C. W., **J. Chen**, S. Hubbard, D. Kaback, and C. Lebish (2006), HydroImage – a user friendly hydrogeophysical characterization software package, *Eos Trans. AGU*, 87(52), Fall Meet. Suppl., Abstract NS41B-1143.

Hubbard, S., K. Williams, A. Kemna, **J. Chen**, and J. Peterson (2006), Use of geophysical methods to investigate, guide, and access contaminant remediation approaches, *GSA Abstracts*, 38(7), Philadelphia, PA, October 22-25.

Hubbard, S., **J. Chen**, Y. Fang, K. Williams, S. Mukhopadhyay, E. Sonnenthal, K. McFarlane, N. Linde and T. Scheibe (2006), Improved parameterization of hydrological models and reduction of geophysical monitoring data ambiguity through joint use of geophysical and numerical modeling methods, *CWMR*, Copenhagen, June 19-23.

Chen, J., M. Hoversten, D. Vasco, Z. Hou, and Y. Rubin (2005), Markov chain Monte Carlo based approaches for inverse problems, *Eos Trans. AGU*, 86(52), Fall Meet. Suppl., Abstract H21G-07.

Hubbard, S., J. Peterson, **J. Chen**, K. Williams, M. Conrad, B. Fabishenko, P. Long, A. Willett, and T. Hazen (2005), Geophysical monitoring of Cr(VI) bioreduction at the Hanford 100H Site, *Eos Trans. AGU*, 86(52), Fall Meet. Suppl., Abstract H44C-03.

Hoversten, M., E. Gasperikova, **J. Chen**, and G. Newman (2005), Joint inversion of marine seismic and CSEM data for fluid saturation prediction, *Eos Trans. AGU*, 86(52), Fall Meet. Suppl., Abstract GP41B-0882.

Hou, Z., **J. Chen**, and Y. Rubin (2005), On application of ground-penetrating radar tomography in shallow subsurface hydrological parameter estimation, *Eos Trans. AGU*, 86(52), Fall Meet. Suppl., Abstract H43J-01.

Hubbard, S., **J. Chen**, K. Williams, J. Peterson, and Y. Rubin (2005), Environmental and agricultural applications of GPR, *International Workshop on Ground Penetrating Radar Invited Keynote*, Delft, Netherlands, May 2-4.

Chen, J., S. Hubbard, M. Fienen, T. Mehlhorn, and D. Watson (2003), Estimating hydrogeological using high-resolution geophysical data and Markov chain Monte Carlo methods, *Eos Trans. AGU*, 84(46), Fall Meet. Suppl., Abstract H21F-04.

Rubin, Y., **J. Chen**, Z. Hou, M. Kowalsky, and S. Hubbard (2003), Bayes, Zadeh, and Shannon, and the development of a structured approach to the hydrogeological data fusion problem, *EGS-AGU-EUG Joint Invited Assembly, Nice, France, Geophysical Research Abstract 5, 02403*.

Chen, J., S. Hubbard, Y. Rubin, C. Murray, E. Roden, and E. Majer (2002), Geochemical characterization using geophysical data and Markov chain Monte Carlo methods, *Eos Trans. AGU*, 83(47), Fall Meet. Suppl., Abstract H52F-10.

Rubin, Y., **J. Chen**, S. Hubbard, M. Kowalsky, and A. Woodbury (2002), A structured approach to Bayesian data fusion, *Eos Trans. AGU*, 83(47), Fall Meet. Suppl., Abstract H52F-05, Invited.

Hubbard, S., K. Williams, **J. Chen**, Y. Rubin, and E. Majer (2001), Characterization and monitoring of the Oyster Bacterial Transport Site using geophysical data, *GSA Abstracts*, Boston, Nov. 1-10.

Hubbard, S., **J. Chen**, B. Mailloux, E. Majer, and Y. Rubin (2000), Heterogeneity and bacterial transport at the Oyster, VA Site, *Eos Trans. AGU*, 81(48), Fall Meet. Suppl., Abstract B51C-01.

Swift, D., M. Green, **J. Chen**, S. Hubbard, E. Majer, and M. Christopher (2000), Deriving hydrofacies from lithofacies at the Oyster Virginia experimental site, *Eos Trans. AGU*, 81(48), Fall Meet. Suppl., Abstract B52A-04.

Christopher, M., E. Roden, K. Overstreet, Y. Chien, **J. Chen**, and S. Hubbard (2000), Spatial heterogeneity of microbial iron reduction potential at the South Oyster Focus Area, Virginia, *Eos Trans. AGU*, 81(48), Fall Meet. Suppl., Abstract B51C-11.

Chen, J., S. Hubbard, and Y. Rubin (1999), Estimating hydraulic conductivity at the Oyster (VA) Site from hydrological and geophysical data by using Bayesian methods based on a normal linear model, *Eos Trans. AGU*, 80(48), Fall Meet. Suppl., Abstract GP31B-10.

Green, M, D. Swift, **J. Chen**, S. Hubbard, E. Majer, and C. Murray (1999), Heterogeneity at the Narrow Channel Site, Oyster, VA: a statistical approach to assess the sedimentary facies prior to correlations with permeability and geophysical imaging, *EOS*, Washington D.C.